BRITISH WEST INDIES
CENTRAL SUGAR CANE BREEDING STATION

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INSTITUTE

REPORT FOR THE YEAR
ENDING SEPTEMBER 30TH, 1935.

Advocate Co., Ltd.—Printers and Book-Binders to the Government of Barbados.

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BRITISH WEST INDIES SUGAR CANE BREEDING STATION.

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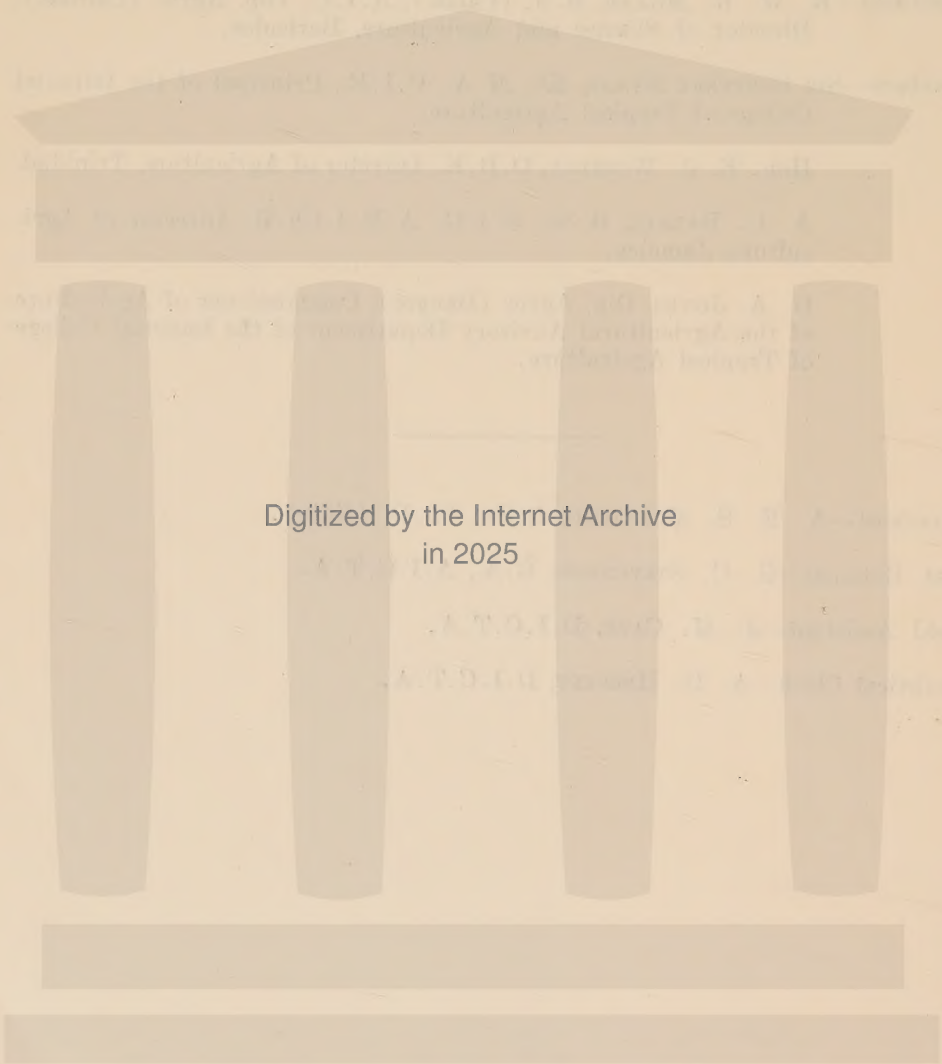

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Report of the Geneticist for the Year Ending September 30, 1935.

I.—SUGAR CANE BREEDING, SEEDLING SELECTION AND TRIALS.

(i) *Sugar Cane Breeding—B.37′ Series.*

Sugar cane breeding was carried out at Lion Castle estate during October, November and December, 1934. The technique employed in the breeding work has recently been described in detail in a separate publication (7).

The sex of fifty-six varieties, employed as parents for the first time, was determined. Of these the following are perhaps of general interest:—

Variety.	Sex.
D.625	Strong ♂
B.6450	Strong ♂
B.6835	Strong ♂
Bourbon	♂
Synthetic Kassoer	♂
Kassoer	♂
Saccharum spontaneum (local Coimbatore form)	Strong ♂
Hathooni	♂
Hemja	♂
Uba (Indian)	♂
Uba (Hawaiian)	♂

The extent and nature of the crossing work is shown below:—

(a)	Crosses between "noble" varieties (*Saccharum officinarum*).	
	(1) between Barbados varieties	18
	(2) between Barbados and imported "noble" varieties	2
(b)	Cross between Barbados variety and *Saccharum spontaneum* (Coimbatore form)	1
(c)	Crosses between Barbados varieties and *Saccharum spontaneum* nobilisations (Kassoer and Toledo)	
	(1) second nobilisation	3
	(2) third nobilisation	4
	(3) fourth nobilisation	26
	(4) fifth nobilisation	7
	Carried Forward	61

	Brought Forward	61
(d)	Crosses between Barbados varieties and *Saccharum barberi* (Hemja and Hathooni)	2
(e)	Crosses between Barbados varieties and *Saccharum baberi* nobilisations (P.O.J.'s 213, 234, 2379 and Co.213).	
	(1) second nobilisation	3
	(2) third nobilisation	2
(f)	Crosses between Barbados varieties and *Saccharum sinense* (Uba)	2
(g)	Crosses involving *Saccharum officinarum, S. spontaneum* and S. *barberi* blood	7
		77

The following new crosses, included in the above summary, are of interest:—

(a) (1) Ba.11569 x D.625.
(2) Ba.11569 x B.6450.
„ x B.6835.
Bourbon x B.H.10(12).

(b) Ba.11569 x *Saccharum spontaneum* (local Coimbatore form).

(c) (1) Synthetic Kassoer x B.H.10(12).
Kassoer x B.H.10(12).

(d) Hathooni x B.H.10(12).
Hemja x B.H.10(12).

(e) (1) Co.213 x Burke.
P.O.J.213 x B.2935.

(f) Uba (Hawaiian) x B.H.10(12).
Uba (Indian) x B.2935.

(g) Co.213 x P.O.J.2878.

(ii) *Seedling Raising and Planting out—B.37′ Series.*

The usual procedures were followed for collecting and sowing the arrows and fuzz and making germination counts.

The following new and considered important crosses proved to be highly fertile:—

Ba.11569 x Burke.
„ x B.6450.
„ x B.6835.
„ x D.625.
Bourbon x B.H.10(12).
Ba.11569 x *Saccharum spontaneum* (local Coimbatore form).

The following were of average fertility:—

Uba (Hawaiian)	x	B.H.10(12).
Uba (Indian)	x	B.2935.
Kassoer	x	B.H.10(12).
Synthetic Kassoer	x	„
Co.213	x	P.O.J.2878.

The following were of poor fertility:—

P.O.J.213	x	B.2935.
Co.213	x	Burke.
Uba (Hawaiian)	x	P.O.J.2878.

The following produced no seedlings:—

Hemja	x	B.H.10(12).
Hathooni	x	B.H.10(12).

The fourth and fifth nobilisations of Java *Saccharum spontaneum* were highly fertile.

The cross, Ba.11569 x Co.281, proved to be highly fertile this season, while the cross Ba.11569 x Co.290 gave very poor germinations.

The seedlings were potted during January and February, 1935. Pottings were allocated as follows:—

A. Proven Crosses (All are crosses between Barbados varieties which have been shown, by experiment, to produce seedlings of high standard).

Number.	*No. of Seedlings Potted.*
5	7,216.

B. Semi-proven Crosses (These are crosses which have not yet been tested or tested insufficiently, but which are considered distinctly promising as producers of good seedlings. All are crosses between noble varieties).

Number.	*No. of Seedlings Potted.*
7	4,016.

C. Experimental Crosses (Trial Marriages).

(a) Crosses between noble varieties.

Number.	*No. of Seedlings Potted.*
7	1,247.

(b) Nobilisations.

(i) Chunnee (*S. barberi*).

2nd degree.

Number.	*No. of Seedlings Potted.*
2	192.

3rd degree.

Number.	*No. of Seedlings Potted.*
2	219.

(ii) Uba (*S. sinense*).

1st degree.

Number.	*No. of Seedlings Potted.*
2	165.

(iii) *S. spontaneum* (local Coimbatore form).

1st degree.

Number.	*No. of Seedlings Potted.*
1	254.

(iv) *S. spontaneum* (*tabongo*-North Celebes form).

2nd degree.

Number.	*No. of Seedlings Potted.*
1	154.

3rd degree.

Number.	*No. of Seedlings Potted.*
2	152.

(v) *S. spontaneum* (*glagah*-Java form).

2nd degree.

Number.	*No. of Seedlings Potted.*
2	262.

3rd degree.

Number.	*No. of Seedlings Potted.*
2	500.

4th degree.

Number.	*No. of Seedlings Potted.*
19	3,179.

5th degree.

Number.	*No. of Seedlings Potted*
7	1,240.

(vi) Nobilisations incorporating blood of several *Saccharum* species.

Number.	*No. of Seedlings Potted.*
5	1,185.

A summary of the above details is given below:—

Group.	*Number.*	*No. of Seedlings Potted.*
Proven Crosses	5	7,216
Semi-proven Crosses	7	4,016
Experimental Crosses:		
(i) between noble varieties	7	1,247
(ii) nobilisations	45	7,502
Totals	64	19,981

In general, it may be stated that noble cane breeding is intended to provide seedlings for areas in the British West Indies which possess good growing conditions and are free from major diseases or pests, higher degrees of nobilisation are intended to provide seedlings for areas with good growing conditions but dominated by some major disease (e.g. mosaic), while the lower degrees of nobilisation are being made to provide seedlings for (a) areas with poor soil conditions and (b) use as parent plants in further nobilisation schemes.

An important alteration in the testing of first year seedlings, which was envisaged last season, was carried into effect with the above seedlings. The alteration and the reasons for it were described in a footnote on page 6 of the Report of the Geneticist for the Year 1933—34*. Briefly, the seedlings are now transplanted from the pots into a field nursery where they will be grown until November of this year and the majority replanted then for a test lasting until the crop of 1937. There will therefore be no B.36′ series of seedlings. The field nursery chiefly provides planting material for a November planting, although it is the intention to effect a minor elimination in the nursery prior to planting in first year trials. It is hoped that this nursery stage may be unnecessary should fuzz storage tests show that it is practicable to obtain the necessary number of seedlings by storing fuzz and sowing it in July so that potted seedlings are ready for planting in November (see note on Fuzz Storage Experiments).

The field nursery was planted during March and April, 1935. The plants were spaced closely and inserted in small cane holes (three of these being made in the length normally occupied by one cane hole).

The seedling populations were kept distinct in blocks: otherwise no special layout was employed. Planting allocations in the field nursery are noted below.

* Agric. Journ., Dept. Sci. & Agri., Barbados, Vol. 3, No. 4, October, 1934.

Group.	No. of crosses.	Number planted.
Proven crosses	5	6,200
Semi-proven crosses	7	1,750
Experimental crosses		
(i) Crosses between noble varieties ..	3	180
(ii) Nobilisations		
(a) *S. barberi*	4	313
(b) *S. sinense*	2	160
(c) *S. spontaneum* (local Coimbatore form)	1	230
(d) *S. spontaneum* (North Celebes form)	3	235
(e) *S. spontaneum* (Java form) ..	27	2,610
(f) derived from blood of several *Saccharum* species	4	545
Total	56	12,223

At the November planting approximately 10,000 seedlings will be planted at the normal cane hole spacing and by a layout essentially similar to that employed during recent years in first year seedling tests. It will therefore be possible at this stage to eliminate approximately 2,200 seedlings. The features for elimination, — always having in mind the special purposes of individual crosses—will be (1) cane width and to a lesser extent (2) number of canes.

(iii) Results of Reaping First Year Seedlings—B.35' Series.

These seedlings were bred in 1933, planted out in April 1934 and reaped during the crop of 1935.

As in 1934, there were three distinct groups:—
(1) Proven Crosses — Early Group.
(2) „ „ — Late Group.
(3) Experimental Crosses (Trial Marriages).

The first group was reaped in February, the second in May and the third in March.

The methods employed in first and subsequent seasons' seedling testing and selection are described in detail in Bulletin 9 of the Station (10).

The final selections are noted below.

A. Proven Crosses.

(i) Early Group.

Cross.	Number Selected.
Ba.11569 x S.C.12/4	26
Ba.11569 x B.417	22
Ba.11569 x Ba.8069	5
*B(30)L 6 x B.H.10(12)	4†
*B(30)L 6 x S.C.12/4	6†

(ii) Late Group.

Ba.11569 x B.H.10(12)	20
Ba.11569 x Ba,6032	7
Ba.11569 x B.603	17
Ba.11569 x B.606	3
Ba.11569 x Ba.8069	1

All these selections, with the exception of those noted thus (†) were retained and multiplied in their respective groups.

These selections are retained for further trial in Barbados.

B. *Experimental Crosses.*

(i) Crosses between noble varieties.

Cross.	Number Selected.
**Ba.11569 x B.H.10(12)	4
„ x B.376	1
„ x B.694	2
„ x Burke	2

These selections were transferred for further tests to the proven cross selections (q.v. above).

(ii) Nobilisations.

(a) Nobilised Java *glagah.* These are mostly nobilisations of the 4th and 5th degree, and represent crosses between Java commercial varieties and Barbados varieties and back-crosses of seedlings derived from these to Barbados and Java (P.O.J. 2878) varieties. They are thick-cane seedlings suited to better soil conditions and a large percentage of them is probably commercially resistant to mosaic disease. In this category *forty-three* seedlings were selected from a total of *seventeen* crosses.

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* B (30) L 6 is a seedling resulting from the cross P.O.J.2364 x B.391.

† These selections, for purposes of further trial, were transferred to the group comprising nobilised seedlings selected from the experimental cross group (q.v.B(ii) below).

**Seedlings comprising a population of this cross are randomised in the experimental cross group to serve as a standard population for comparison with the populations of the experimental crosses .

(b) Seedlings derived from thin cane parents. Their canes tend to thinness. They are probably hardy and suited to poor soil conditions. A considerable percentage may possess resistance to froghopper and mosaic disease.
These selections are noted here.

Cross.	Number Selected.
Toledo x S.C.12/4	12
Co.213 x B.391	3
„ x B.H.10(12)	1
B.3215 x Co.281	2
P.O.J.213 x B.H.10(12)	1

(c) Selections intermediate in type between (a) and (b).

Cross.	Number Selected.
Ba.11569 x Co.290	16
„ x P.O.J.234	8
„ x Co.281	3

In all *ninety-nine* nobilised seedlings were selected. These are now being multiplied for a second year trial in Barbados during the season 1935-37. Prior to planting in November 1935, selections will be made in their multiplication plots so that approximately 40—50 will be tested in this second year trial. The second year trial of the above nobilised seedlings is intended to provide selections of a reasonably good general standard and suited to the various special seedling requirements of the colonies served by the Station. The testing of such nobilised seedlings terminates in Barbados at this second year stage. Further stages in testing are to be carried out in appropriate areas in the colonies concerned.

At reaping, the usual field data was obtained for every seedling in the experimental cross group and sucrose per cent. in juice determinations made for an adequate sample of seedlings from each population.

(iv) Notes on Seedlings Constituting the B.34′ Series of Seedlings.

These were selected in the first year trials reaped in 1934. Selections were made from early and late reaped proven crosses and from experimental crosses. In all, ninety-five *noble cane crosses* were selected. These were put into multiplication plots at Codrington during the spring of 1934. By the crop season of 1935, the multiplication plots of the *early* group selections had grown sufficiently to warrant taking field and sucrose data for each seedling.

During November 1934, all the selections from noble cane crosses were planted in twenty-four cane hole plots at Dodds station. These plots serve (1), to provide sufficient planting material for comprehensive trials of those eventually selected, (2), to test resistance to gumming disease (9) and, (3), to effect elimination of obviously poorer seedlings.

For the early group, the field and laboratory data obtained at Codrington in 1935, and, for both groups, the field and gumming disease resistance data obtained at Dodds during 1935 serves to eliminate some of the seedlings The remainder will be planted in routine second year trials for season 1935-37.

One of these seedlings, i.e. B.3439, looked so promising in the multiplication plots at Codrington that it was promoted direct to the routine second year trials of the B.33' series of seedlings (q.v. section (v) below).

Fifty-two *nobilised* seedlings were selected from the experimental cross group. These represented various degrees of nobilisation, by Barbados varieties, of several wild *Saccharum* species.

These were placed in multiplication plots at Codrington during 1934 and observations made on their growth and appearance throughout the year.

During the planting season in November 1934, they were allocated as follows.

(1) for second year trial at Codrington Experiment Station	..	34
(2) for parent material in breeding plots at Lion Castle	..	36
(3) for tests of resistance to gumming disease at Dodds	..	52

(*v*) *Notes on Seedlings Constituting the B.33' Series of Seedlings.*

These were selected as first year seedlings during the 1933 crop. The *nobilised* seedlings selected then were used for breeding purposes and for tests on the inheritance of gumming disease resistance.

The *noble* seedlings underwent the routine multiplication and minor selection tests described for the corresponding group of the B.34' series (q.v. section (iv))

The final selections made in November 1934, both early and late groups, were planted in second year trials at Dodds (low rainfall station) and Todds (high rainfall station).

(vi.) *Second Year Seedling Trials—B.32' Series*
(Late Group).

The early group of this series was reaped in 1934. (See explanation for this in the Report of the Geneticist, Agri. Journ., Dept. Sci. & Agri., Barbados, Vol. 3, No. 4, 1934, pp. 10-11).

The late group second year trials contained thirteen seedlings. These were tested against the appropriate standard varieties at Dodds (low rainfall station) and Todds (high rainfall station) during season 1933-35. The layout, the methods of reaping, selecting and statistically analysing the results were essentially similar to those employed in previous years' second year trials (10).

Two seedlings were selected for further trials, i.e., B.3259 and B.3267. Both were derived from the cross—Ba.11569 x B.H.10(12).

The following short notes are made for each.

B.3259. The canes are above average number, of good length and average width and yield a good tonnage under higher rainfall conditions. The juice quality was high. This seedling will be tested in the intermediate and higher rainfall districts in Barbados.

B.3267. The canes are below average number but individually of excellent appearance, being long and thick and remaining sound. Tonnages were good, more especially at the higher rainfall station. The juice quality was below average. This seedling will be tested over a range of conditions experienced over the low-intermediate to higher rainfall districts in Barbados.

As customary for selections from the second year trials, these seedlings will be tested in select seedling trials and maturity experiments. Their growth will be recorded in the latter.

(vii) *Select Seedling Trials.**

(a) *Plant Canes—B.31 Series.*

These trials were designed to test second year selections of the B.31′ series, i.e. B.3124, B.3125, B.3127, B.3138. In addition, the earlier seedlings—B.2977, B.3011 and B.3013 were included for further test. The standard varieties used in trials appropriate to each were—B.2935, Ba.11569, B.726 and B.H.10(12).

Six stations were selected to represent the various soil and climatic conditions. These were:—

(1) Haymans .. .. Sandy coral limestone soil, low rainfall.
(2) Oldbury .. .. Shallow black coral limstone soil, low rainfall.
(3) Frere Pilgrim .. Shallow black coral limestone soil, low—intermediate rainfall.
(4) Buttals .. .. Deep valley black coral limestone soil, low-intermediate rainfall.
(5) Woodland and Guinea .. .. Shallow red coral limestone soil, intermediate—high rainfall.
(6) Cottage .. .. Shallow red coral limestone soil, high rainfall.

At each station, two contiguous trials were planted—one for early, the other for late reaping.

General Observations on Rainfall During the Season 1933-35.

The rainfall during the early months of the rainy season in 1934 was reasonably good. The rainfall during October and November, however, was extremely low and threatened to ruin part of the crop in the lower-rainfall district. Good rains fell during December and January (1935) and served to revive the crop to an appreciable extent.

The rainfall shortage during October and November served to depress the yields of all varieties but more especially the long season types. The varieties are listed here in the order in which they may be said to have suffered from these low rains—B.H.10(12), B.3013, B.726, B.2935, Ba.11569.

* The select seedling trials and variety trials described here were carried out in Barbados. The results obtained, however, serve to guide future allocations of seedlings to fertile soil areas free from major pests or diseases in the Colonies served by the Station.

FIG I

SELECT SEEDLING TRIALS

Plant Canes Early Reaping

Saccharose in thousands of pounds per acre

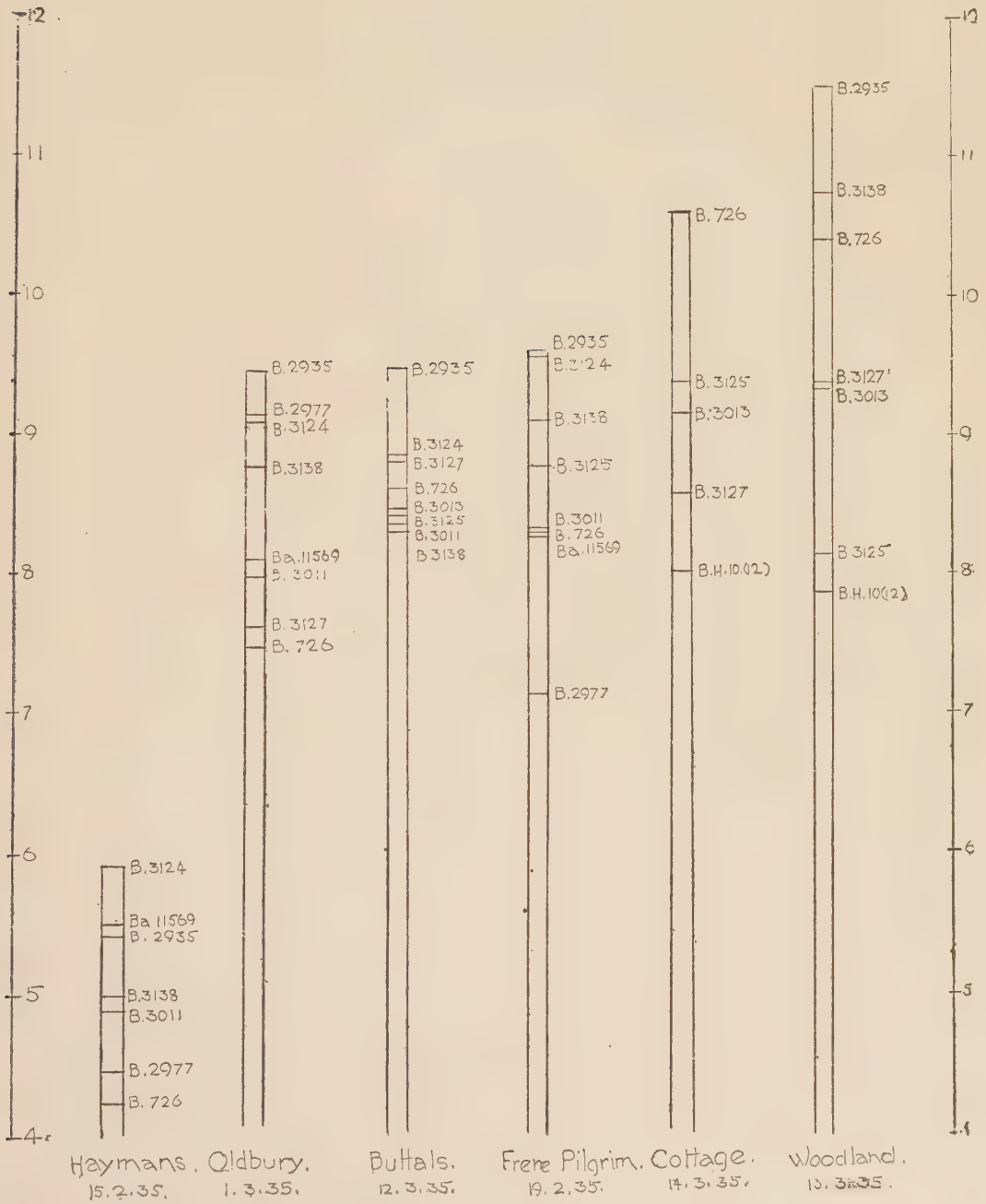
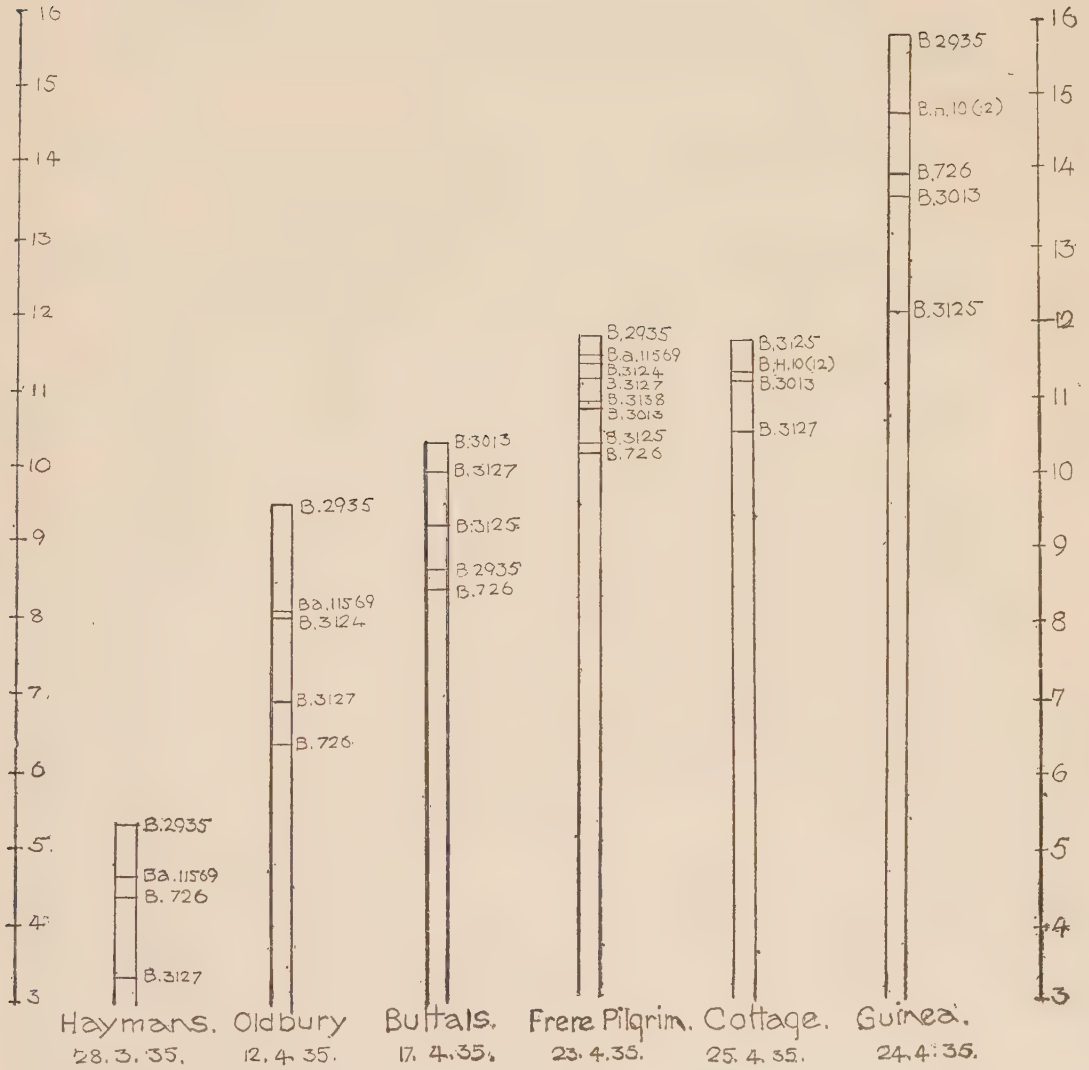


FIG II

SELECT SEEDLING TRIALS.

Plant Canes. Late Reaping.

Saccharose: in thousands of pounds per acre.



The retardation of growth during October and November and the good rains later caused a late growth.

This late growth was responsible for a late maturation, particularly in the higher-rainfall districts. At the same time, it was also responsible for the comparatively low percentage of rotten cane experienced at reaping.

Comments on the Trials. From a statistical point of view all the trials, with one exception, were satisfactory. The exception was the early reaping at Cottage. A statistical analysis of this trial indicated that little or no reliability could be placed on its results.

The late reaping at Guinea—an estate near to Woodland—was made to serve as a late reaping for Woodland. This was done on account of its being impracticable to obtain a field large enough to accommodate both time-of-reaping trials on the latter estate.

Results of the Trials. A summary of variety and seedling yields of saccharose per acre is presented in diagrammatic form in Figs I and II.

Comments on the Results of the Trials. In considering the results, the effect of the very low October and November rains on the several varieties and seedlings must be kept in mind.

In general, all the seedlings showed up well against the standard varieties and would appear to render difficult making finite conclusions on each. Their growth, however, was recorded throughout the year and in addition each was reaped in the maturity experiments. With all the data on hand, the following notes are appended both for varieties and seedlings.

B.2935. This new standard variety excelled practically in all trials. The exceptions were the early reaping at Haymans and the late reaping at Buttals. Under conditions represented by Haymans, it is possible that it may be bettered as an early variety by a seedling with somewhat fewer canes per stool and better early juice qualities, e.g. B.3124. In the deep valley soils—as represented by Buttals—it tends to rot towards the end of the crop.

The high returns recorded by B.2935 at the intermediate-high rainfall stations—Woodland and Guinea—are not surprising in a low-rainfall year. Previous trials have shown that this variety tends to rot readily in a season of average rainfall in districts represented by these stations and it would be unwise to plant it on any appreciable scale in such districts.

Ba.11569 The season under review was more favourable to the growth-type of Ba.11569 than to that of B.2935. In spite of this, the latter variety is seen to be better than Ba.11569 in five out of six trials. B.2935 is undoubtedly a better plant cane variety that Ba.11569. Ratooning is considered in subsection (b) of this section and in section (viii) below.

B.726. This variety is severely penalised by rainfall shortage during the rainy season. This shortage was especially marked at the lower-rainfall stations As a result, B.726 yielded relatively poorly at these stations. In these trials it was chiefly intended to serve as a standard for the early reaping. On account

of the unfavourable season it has failed in this purpose at the lower-rainfall stations. In view of the fact that B.726 is liable to suffer in a poor rainfall year and that B.2935 ripens rather later in crop, it is evident that an early ripening seedling is required for the lower-rainfall districts.

B.726, on the other hand, performed very well at the higher-rainfall stations. Owing to the late growth of the season, its usual late crop rotting was little in evidence.

B.H.10(12). This variety suffered particularly as a result of the low rainfall. It is a long season variety requiring a long and sustained rainy season. It undoubtedly made much growth during December, January and February and was very green when reaped. As a result it was very immature at the early reapings and gave very low sugar returns. At the late reapings it had ripened and yielded very well. It is undoubtedly best to plant both B.726 and B.H.10(12) in the higher rainfall areas; the former to provide ripe canes early in crop.

B.2977. This seedling germinated badly and yielded irregularly. It is now discarded.

B.3011. This seedling was tested as an early seedling for lower and lower-intermediate rainfall conditions. It germinates well and grows evenly. The cane number is above average, but the canes tend to thinness. It does not promise to yield so well as B.2935 and is therefore discarded.

B.3013. This seedling shows considerable promise. Growth measurements and maturity experiments have shown it to have a length of growing season intermediate between B.726 and B.H.10(12). Its canes are of average number and length but of variable width. They remain remarkably sound during crop and weigh well. They are easily reaped. The juice quality is very high. Indications from its trials are that it shows considerable promise as an intermediate crop variety in the higher-rainfall district, a late crop variety in the intermediate rainfall district and more especially in the deep valley soils. This seedling has been planted in variety trials (q.v. section (viii)).

B.3124. This seedling is essentially suited as an early cane under lower-rainfall conditions. The number of canes per stool is average. The canes are long and of average width. They rot readily if kept for any length of time during crop. The juice quality is high early in crop.

This seedling gives a certain amount of promise as an early variety for a restricted area in the lower-rainfall shallow black coral limestone and sandy coral limestone soils. It is being multiplied for test against B.2935 and B.726 in variety trials in these areas during 1935-37.

B.3125. This seedling is suited essentially to early reaping, in intermediate and higher-rainfall areas. It possesses considerably above the average number of canes per stool and thus appears to be unable to withstand prolonged dry conditions. The canes are of good width but have a short season growth. As a result they ripen early but rot readily. The juice quality is very high. It is essentially a competitor of B.726 and B.3013 but it is doubtful if it will better these. It has been re-included in select seedling trials for season 1934-36.

B.3127. This seedling possesses an average number of canes per stool. The canes are long and of good width. They, however, root heavily at the nodes and thus make reaping difficult.

This seedling does not appear to come up to commercial standard. It has, however, been re-included in select seedling trials for season 1934-36.

B.3138. This is an unusual type of Barbados seedling. The growth habit very much resembles that of P.O.J.2878. It is difficult to germinate and considerable computation had to be made at reaping to establish its tonnages. As a result its yield figures cannot be considered very reliable. The cane number is average. The canes are very variable in width and length. It does not appear to be promising but is re-included in the select seedling trials for season 1934-36.

(*b*) *First Ratoons.—B.29′ and B.30′ Series.*

Two of the plant cane select seedling trials of season 1932-34 were cut as ratoons in 1935.

These were:—

Small Ridge .. .. Shallow black coral limestone soil, low-intermediate rainfall.

Bowmanston .. .. Shallow red coral limestone soil, intermediate-high rainfall.

For each plot the yield of cane and number of dead canes were ascertained.

The yields are presented in Table I.

TABLE I.

Station	Variety and Yield in Tons Per Acre.				
	Ba.11569	B.2935	B.726	B.H.10(12)	B.3013
Small Ridge ..	24.55	26.24	22.09	—	22.00
Bowmanston ..	—	35.63	33.85	28.96	33.86

The chief object of these reapings was to furnish contributory evidence as to the ratooning powers of B.2935 and B.3013. The variety B.2935 is regarded chiefly as a competitor of Ba.11569 in the lower and lower-intermediate rainfall districts. In this respect, the result at Small Ridge shows that it performs satisfactorily. This aspect will be further considered below in Section (viii), subsection (b).

The seedling B.3013 is competing essentially with B.726 over a range of conditions from intermediate to high rainfall. In the above trials it compared well with B.726, and in view of its being much easier to cut and less susceptible to rotting, it gives promise of displacing, at least in part, the variety B.726 as a commercial variety in these districts. It has been planted in an extensive series of variety trials for season 1934-36. (See Section (viii) subsection (a) below.)

(viii) VARIETY TRIALS.

(a) *Plant Canes.*

The nature of the recently instituted co-operative variety trials in Barbados has been described in detail in the Report of the Geneticist for season 1933-34 (Agri. Journ. Dept. Sci. and Agri., Vol. 3, No. 4, pp. 15-22).

The trials completed during crop 1934 indicated that two seedlings—B.3013 and B.3234—were sufficiently promising to warrant inclusion in variety trials.

Results up to that date suggested that those seedlings were promising for the conditions noted below.

B.3013. This seedling would appear to be best suited to early reaping in the low-intermediate rainfall areas, to late reaping in the valley soils; to early and midcrop reaping in intermediate and higher rainfall areas.

B.3234. This seedling would appear to be best suited to late reaping in intermediate-high and higher rainfall areas; i.e. it appears to be directly competing wth B.H.10(12).

To test those indications thirteen stations were chosen. These were chosen as follows:—

Conditions.	*Number of Stations.*
High rainfall, shallow red coral limestone soils	3
Intermediate-high rainfall, shallow red coral limestone soils	4
Intermediate rainfall, shallow red coral limestone soils	3
Low-intermediate rainfall, deep valley black coral limestone soils	1 (two trials on one station).
Low-intermediate rainfall, shallow black coral limestone soils	2

In the last category noted above, B.3013 is being tested against B.726 and B.2935 for early reaping in crop.

In all other stations each trial comprises the following—B.726, B.H.10(12), B.3013 and B.3234.

These trials will be reaped during crop in 1936.

(b) *First Ratoons.*

In season 1932-34, a series of plant cane trials was carried out to test the then seedling B.2935 as a plant cane against Ba.11569, B.726 and B.891 in the low and low-intermediate rainfall district. From these trials, it was concluded that B.2935 was the best plant cane variety for these districts.

It was desirable to test its ratooning ability under these conditions, since a certain amount of ratooning is done in these areas.

Four of the trials were cut as ratoons in 1935. The results are noted in Table II.

TABLE II.

Station.	Variety and Yield in Tons Per Acre.			
	B.2935.	Ba.11569	B.726.	B.891.
Ridge	28.61	..	23.67	20.65
Edgecumbe	24.88	28.15	25.05	..
Bourbon	15.13	15.70	..	11.51
Bulkeley	25.48	..	25.26	25.79

The conditions for ratoon springing during the crop of 1934 were unusually severe; the rainfall being persistently very low during the dry-season months. It would appear, from observations made, that B.2935 does not shoot so readily under severe conditions as Ba.11569 and B.726. Under less severe dry-season conditions it shoots readily and yields well as a ratoon (c.f. results of trials at Small Ridge and Bowmanston, Section (vii) and results of this series at Ridge).

In view of its high yield of plant cane over the conditions under review here and its satisfactory yield as a ratoon it would appear to be the best variety for commercial planting.

II. DESPATCH OF SUGAR CANE SEEDLINGS TO BRITISH WEST INDIES CENTRAL PLANT QUARANTINE STATION, TRINIDAD.

During the year under review, cuttings of the following seedlings were sent for quarantine to the Central Plant Quarantine Station in Trinidad:— B.2931, B.2935, B.2977, B.3011, B.3013, B.3124, B.3125, B.3127, B.3138, B.3179, B.3216, B.3234, B.3239, B.3259, B.3267, B.3439, B.3215, B.3254.

The seedlings B.3215 and B.3254 are intended for test in Jamaica in fertile soil areas where mosaic disease is uncontrollable. Both are seedlings derived from P.O.J.2725 crossed with Barbados varieties. They resemble noble canes in appearance and gave very good yields in routine second year trials in Barbados.

The other seedlings are derived from noble cane parentage. So far, the seedling B.2935 only of these has been tested in two Colonies, i.e., Antigua and St. Kitts. The results of these tests show it to perform very well in both islands and suggest that it will become, as in Barbados, a commercial variety in the lower-rainfall districts. Although it has not been tested in the other islands, it is probable that it will be suited to parts of Jamaica, St. Lucia and Grenada.

With regard to the other noble cane seedlings, and since their despatch to the Central Plant Quarantine Station, more information on each has been obtained in Barbados. Thus a selection only from them will be recommended for tests in the islands in areas considered appropriate to each selected one.

It is anticipated that selections of seedlings for trial in poor soil areas and areas susceptible to mosaic disease and froghopper blight will be available for despatch to the Central Plant Quarantine Station during the 1936 crop. These selections will be made from the special second year seedling trial now being conducted in Barbados and reported here on page 8.

III. SUGAR CANE VARIETY TESTS IN THE BRITISH WEST INDIES.

During the year under review, progress reports on trials in the Leeward Islands were received at the Station. The results from reaping trials in these islands during the crop of 1935 were forwarded to the Station, after being subjected to statistical analyses. Comments were made on the results and suggestions made as to choice of varieties and their allocation for further tests.

A scheme for testing varieties in variety trials in St. Lucia was submitted to the Commissioner of Agriculture for the British West Indies.

Recommendations for sugar cane variety plantings in Grenada were forwarded to the Director of Agriculture, Trinidad.

IV. VISIT TO ANTIGUA.

A second visit was made to Antigua during the year. This visit has been reported in detail in Bulletin 7 of the Station (8).

During this visit, advantage was taken to obtain further knowledge on the agricultural properties of the complex sugar cane soils. Further observations were made on sugar cane growth phenomena in the island. The sugar cane variety situation was again reviewed and notes made on the status of the varieties now grown. Recommendations were given for future sugar cane seedling and variety trials and further observations made as to the sugar cane seedling requirements of Antigua.

V. SPECIAL INVESTIGATIONS IN SUGAR CANE.

These were carried out in Barbados. The root system and gumming disease investigations are reported on below by the Assistant Botanist. The others are considered here.

(i) *Growth Measurements and Maturity Experiments.*

These are designed, for each seedling reaching select seedling stage, to note under two environments its growth throughout the season and its rate of vegetative and chemical maturity during crop. From the information derived the general effect of environment on growth and maturity is studied. In particular, the reaction of each seedling to environment is ascertained. This determines the growth-type of each and this knowledge is used for each seedling conforming to a required general standard, to allocate it for further trial in the British West Indies.

During this year growth measurements are being made on the seedlings B.3013, B.3125. B.3127, B.3138, B.3216, B.3234, B.3239.

For the season terminating during the crop of 1935 growth measurements were made on and maturity data obtained for B.2931, B.2935, B.2977, B.3011, B.3013, B.3124, B.3125, B.3127, B.3138, B.3179. P.O.J.2878 was also included in this series.

(*ii*) *Experiments in the use of the Zeiss Hand Refractometer.*

Experiments with the Zeiss Hand Refractometer have been started with two main objects in view, i.e. (1) to find out in how far this instrument is reliable in indicating the sucrose content of the juice of first year seedling populations, individual first year seedlings and samples drawn from plots of second year seedlings and (2) to note in how far it is possible by its use to determine the relative rates of chemical maturity of seedlings.

Under the first head, the degree of reliability is being ascertained by a system of correlating brixes obtained from the Zeiss Hand Refractometer with sucrose per cent. in juice figures obtained by laboratory methods.

A varying number of field sampling techniques were employed during the 1935 crop for both first and second year seedlings and the comparative values of each ascertained by correlation. The results of each have been determined. These will be published in detail in the January 1936 number of the Agricultural Journal of the Department of Science and Agriculture.

It appears that, by employing certain field sampling methods, sufficiently accurate indications of the sucrose in juice are obtained for first year seedlings and populations and second year seedlings, to render the use of the Zeiss Hand Refractometer reliable in these cases. The result of this will be to facilitate and extend this aspect of the work in seedling selection.

In regard to the use of the Zeiss Hand Refractometer in determining the rates of chemical maturity in seedlings, an opportunity was taken to test it in the maturity experiments.

It was possible to determine the effect of environment, type of cane, position in the cane and variety on rate of juice ripening. The experiments under this head will be continued for several seasons.

(*iii*) *Fuzz Storage Experiments.*

The desirability of conducting these was noted early in this report (see page 5).

A series of fuzz storage experiments was carried out on fuzz obtained from crosses made during the breeding season, October—December, 1935. This series has been concluded. The experiments will be reported in detail in the near future. For purposes of report here a summary of the experiments is given below.

(1) Within recent years in Barbados it has been considered desirable to delay planting the first year sugar cane seedling trial until approximately eleven months after harvesting the fuzz. This has rendered necessary the use of one of two methods, i.e. (1), sowing the fuzz soon after harvesting the arrows and planting the seedlings in a field nursery to provide planting material in eleven months time or (2) storing the fuzz for eight months and sowing to provide seedlings for field planting eleven months after harvesting the fuzz. The former method is at present adopted pending investigations into the possibilities of the latter method. The latter method if reliable would be more convenient and less expensive.

(2) Fuzz storage tests were made with fuzz from twenty-one crosses. The fuzz of each was subjected to four different treatments.

All fuzz samples were stored in sealed tins in (1), an ordinary atmosphere (2), an atmosphere of CO_2 (3), an ordinary atmosphere plus $CaCl_2$ and (4) an atmosphere of CO_2 plus $CaCl_2$

The $CaCl_2$ was used at the rate of 15 grams per 1000 cc. of storage space.

All tins were stored at room temperature.

(3) After approximately eight months' storage, fuzz germinations were ascertained and compared with germinations from immediate sowings.

(4) The results showed that no germinations were obtained from fuzz stored in an ordinary atmosphere or in an atmosphere of CO_2. With $CaCl_2$ in an ordinary atmosphere, 7% of the original germinations were obtained, with $CaCl_2$ in an atmosphere of CO_2, 25 per cent.

(5) Although the evidence is incomplete, indications were that there was little difference in retention of viability in storage between crosses of various relationships to the species of *Saccharum*.
There was a marked difference in retention of viability shown by the different crosses.

(6) The conclusions are that fuzz storage in Barbados with the treatments employed is not suited to the scheme of breeding and seedling raising employed.

(7) Future experiments will be directed towards improving the degree of viability after storage and noting in how far the extent of germination in crosses after storage is a genetic characteristic.

REPORT OF THE ASSISTANT BOTANIST.

I.—STUDIES ON ROOT DEVELOPMENT OF THE SUGAR CANE.

(1) Introduction.

Studies on the root development of the sugar cane were begun in 1933. The first investigation, involving a study of the development of the root systems of several varieties under the environmental conditions of the season 1933-34, has been reported in detail elsewhere (6).

It was evident that the features of varietal root development noted in this investigation referred to a particular set of environmental conditions, and it was considered advisable to conduct a further investigation on similar lines in order to note the effect of the probably different conditions (more particularly rainfall) of the season 1935-36 on root development and distribution.

This second investigation is at present in progress, and is outlined in the following sections:—

(ii) Material and Methods.

The varieties included in the second investigation are B.H.10(12), Ba.11569, B.726, P.O.J.2878, B.2935, Co.213, Uba and *Saccharum spontaneum* (local Coimbatore form). Of these the first four were studied in the first investigation, referred to above, and were re-included in order to note the effect of season on the root development of varieties. The remaining four varieties were included in order to provide material representing a wide range of parental types.

The experimental procedure in this investigation is essentially the same as was employed previously, and is fully described in the publication referred to. Certain minor alterations were made necessary on account of the increase in the number of varieties from five to eight. Some improvements in technique, more particularly in respect of comparing the absorbing capacities of root systems, were made possible by the light of experience gained in the first investigation.

The investigation involves four examinations of the root systems during the growing season, two of which have now been made. The times of examination correspond to those of the examinations in the first investigation.

The following sections summarise the more important findings of the first and second examinations:

(iii) The First Examination.

The first examination was made in May 1935, approximately four months after planting the stools in the field. The soil of the experimental plot was slightly deeper than that in the plot occupied by the 1933-34 investigation, but was apparently similar in other respects. The most notable climatic difference between the two seasons was the relatively high dry season rainfall prior to the second investigation. This resulted in a considerably higher moisture

content of the upper layers of the soil prior to and at the time of the first examination than had obtained at the corresponding period in 1933. The response on the part of the root systems to this increased soil moisture was clearly marked. Primary roots were shorter, but more branched, and tended to grow in directions more nearly horizontal than in May 1933, when primaries tended to be long and almost unbranched, and to strike vertically or obliquely into the lower soil layers. Along with this early differentiation of roots, varietal characteristics were beginning to manifest themselves at an earlier stage than in the first investigation. Heavy tillering varieties (e.g. Uba) had a correspondingly large root mass, and the early, fast-growing types such as *Saccharum spontaneum* Co.213 ,and to a lesser extent B.2935, showed an early and profuse development of short, actively-absorbing, fibrous roots on the primary roots and branches when compared with a later type such as B.H.10(12).

(iv) The Second Examination.

The second examination was made in August-September 1935, following a period of high and well-distributed rainfall, and when rapid growth of the canes was taking place. Analysis of the results of this examination has not been completed, but certain features of importance have been noted. The early and rapid differentiation of primary roots had continued, such that the earliest produced roots had passed through their developmental cycle, and were sometimes in certain varieties already dead. Very few new roots now penetrated the lower soil layers, and the surface six-inch soil layer was becoming increasingly well filled with branched roots. Fibrous roots were abundant, and absorptive capacity apparently high. *Saccharum spontaneum* had continued to produce subterranean tillers, some of which grew at first downward into the soil, and finally emerged more than five feet from the parent stool. Root production from these tillers was evidently continuous as they grew below the soil surface, and the series of roots on such tillers proved instructive in demonstrating the developmental cycle passed through by the roots of this variety.

In view of the early and heavy rains of the present season, the later examinations of root development should show features of considerable interest. The investigation will be reported in full at the conclusion of the work.

(v) Studies on Fibrous Root Production and Root Hair Development.

Fibrous roots would appear to be of great importance to the stools, being heavily covered with root hairs, and evidently efficient in absorption. Direct varietal comparisons of fibrous root numbers on primary roots, worked out on a statistical basis, have been begun and will be continued throughout the investigation.

Microscopic examination of roots for root hair features is made at all stages. In this respect it is of interest to note that not only do root hairs occur near the growing points of roots, and on the fine fibrous roots, but also on the cortex of primary roots at considerable distances from the growing point. They have been found apparently functional after the cortex has become brown and shrivelled, and evidently persist for a considerable time.

(vi) Single Cane Experiment.

An experiment, designed to study the growth and periodicity of roots developed by single canes established in the field after removing the basal buds to prevent tillering, was carried out in August 1934—January 1935. This experiment has been reported elsewhere.* The experiment was not entirely successful but if modified and repeated under more favourable conditions in the future, there were indications that valuable data may be forthcoming. It was found, for instance, that there was reason to believe that the roots of B.726 have a considerably longer effective life than those from comparable canes of Co.281.

II. GUMMING DISEASE INVESTIGATIONS.

(i) Introduction.

In a recent publication (9) a full account of the gumming disease investigations in Barbados, since the first discovery of the disease in 1929 until the present time, was presented. The following sections summarise briefly this publication.

(ii) General Observations.

Primary leaf symptoms of gumming disease are rare under Barbados conditions, though they can be found in highly susceptible varieties. Secondary leaf symptoms occur wherever susceptible varieties are grown. They spread slowly during the dry season and more rapidly after the onset of the rainy season. Varietal differences in the maximum intensity and rate of spread of secondary leaf symptoms are clearly marked, and constitute a convenient method of assessing differences in varietal susceptibility to the disease. From the commercial point of view, however, there is a more serious aspect of the disease. This is systemic infection, which involves production of gum in the canes, and may result in actual death of canes in the field, or interference with sucrose elaboration processes at the factory. In order that comparisons of secondary leaf symptom development might be taken as true indications of degrees of resistance to the disease, it was necessary to conduct an experiment to determine the relationship between these two aspects. This experiment is described fully in the publication referred to above, and is outlined below:—

(iii) Experiment to Determine the Relationship between Leaf Symptom Development and Systemic Infection (production of gum in canes).

Twenty varieties were used, which embraced a wide range in susceptibility to leaf symptom development. Records of comparative leaf symptom development were kept from June 1933 to January 1934 and systemic infection was recorded at intervals during the growing season. This was done by estimating the gum exudation taking place from pieces of cut cane maintained in a moist atmosphere for one day.

Conclusions from the experiment were that, in general, varieties which show high leaf symptom development also show a high degree of systemic infection. Though there were exceptions to this—in particular the variety Ba.11569—in no case was a variety seen to exhibit any appreciable degree of systemic infection unless the development of leaf symptoms was considerable.

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* Agric. Journ. Dept. Sci. & Agric. Barbados, Vol. 4. No. 2. p. 78, April 1935.

Consequently, for the present, it is considered that, for practical purposes, varieties showing little or no leaf symptoms may be regarded as resistant to the disease.

An experiment, which includes a further collection of varieties, is being run during the present season on the same lines in order to test the above conclusions.

(iv) Gumming Disease Resistanse Tests.

Routine resistance tests are included in the scheme of seedling trials, and at the present time all seedlings showing more than moderate susceptibility to the disease are eliminated before their second year trials. The resistance tests are carried out, under conditions of natural infection, in the field, in multiplication plots, which are surrounded by the highly susceptible variety Ba.11569 to provide infective material.

(v) The Inheritance of Gumming Disease Resistance.

Since 1930, when gumming disease resistance testing was started, more than three hundred varieties and seedlings have been tested for gumming disease resistance under Barbados conditions. From the data available it is possible to study the inheritance of gumming disease resistance by calculating resistance fractions for populations from particular parentages. In the publication referred to above, the resistance fractions of various sections, groups and classes of sugar cane varieties are set out in tabular form.

From the results it would appear that practically all seedlings derived from *Saccharum spontaneum*, Linn. and *Saccharum barberi*, Jesw. when crossed with members of the species *Saccharum officinarum*, Linn., are resistant to gumming disease. There is an appreciable percentage of resistant varieties of the species *Saccharum officinarum*, Linn. under Barbados conditions, but in this group the ability of parent varieties to endow resistance to the disease to their off-spring is variable. For instance, varieties in the genealogical line originating in B.1379 are markedly resistant, whilst those in the line derived from B.208 contain a far greater proportion of susceptible types.

The study of the inheritance of gumming disease resistance is being continued.

BRITISH WEST INDIES CENTRAL SUGAR CANE BREEDING STATION.

List of Publications Issued to Date.

(1) "Report for the Period ending September 20th, 1934."

(2) "Report on the Sugar Cane Breeding Problems of Antigua, Trinidad and St. Kitts"—A. E. S. McIntosh, Bull. No. 1, Sept., 1933.

(3) "Report on the Sugar Cane Variety Problems in St. Lucia"—A. E. S. McIntosh, Bull. No. 2, June, 1934.

(4) "Report on a Visit to Jamaica"—A. E. S. McIntosh, Bull. No. 3, Sept. 1934.

(5) "Report on a Visit to Grenada"—A. E. S. McIntosh. Bull. No. 4, Nov., 1934.

(6) "Investigations into the Root Development of the Sugar Cane in Barbados (1) Root Development in Several Varieties under one Environment"—G. C. Stevenson and A. E. S. McIntosh, Bull. No. 5, Feb., 1935.

(7) "An Account of the Policy and Methods Employed in the Breeding and Initial Stage of Selecting Sugar Cane Seedlings"—A. E. S. McIntosh, Bull. No. 6, June, 1935.

(8) "Report on a Second Visit to Antigua"—A. E. S. McIntosh, Bull. No. 7, July, 1935.

(9) "Gumming Disease Investigations in Barbados"—A. E. S. McIntosh and G. C. Stevenson, Bull. No. 8, August, 1935.

(10) "An Account of the Methods Employed in Testing and Selecting Sugar Cane Seedlings for Thick-Cane Areas in the British West Indies"—A. E. S. McIntosh.
"An Account of the Methods Employed in Carrying out Sugar Cane Seedling and Variety Trials in Barbados".—A. E. S. McIntosh and C. B. Foster, Bull. No. 9, Sept., 1935.

BRITISH WEST INDIES SUGAR CANE BREEDING STATION.

STATEMENT OF EXPENDITURE FOR 1934-35.

Recurrent:—

	£	s.	d.
Personal Emoluments	914	5	3
Seedling Trials	378	16	2
Stationery and Publications	121	8	1
Travelling	309	5	2
Contingencies	14	6	9
	1,738	1	5

Capital:—

Purchase of Soil Sterilizer	41	12	4
Installation of Additional Irrigation Pipe Line ..	287	11	2
Laboratory at Codrington Experiment Station ..	77	19	11
	407	3	5

Totals:—

Recurrent	1,738	1	5
Capital	407	3	5
	2,145	4	10